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Research for Particulate Control. EPA's Mobile Test Vans

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1979

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This report discusses EPA's mobile vans and their use in on-site aerosol monitoring. It contains a complete explanation of what is involved in hosting a mobile particulate control van at a plant, including specifications for installation and operation of the equipment.

KEYWORDS: *Aerosols, *Air pollution sampling.

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Research Laboratory
Research Triangle Park
North Carolina 27711

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EPA

Research for Particulate Control

EPA's Mobile Test Vans

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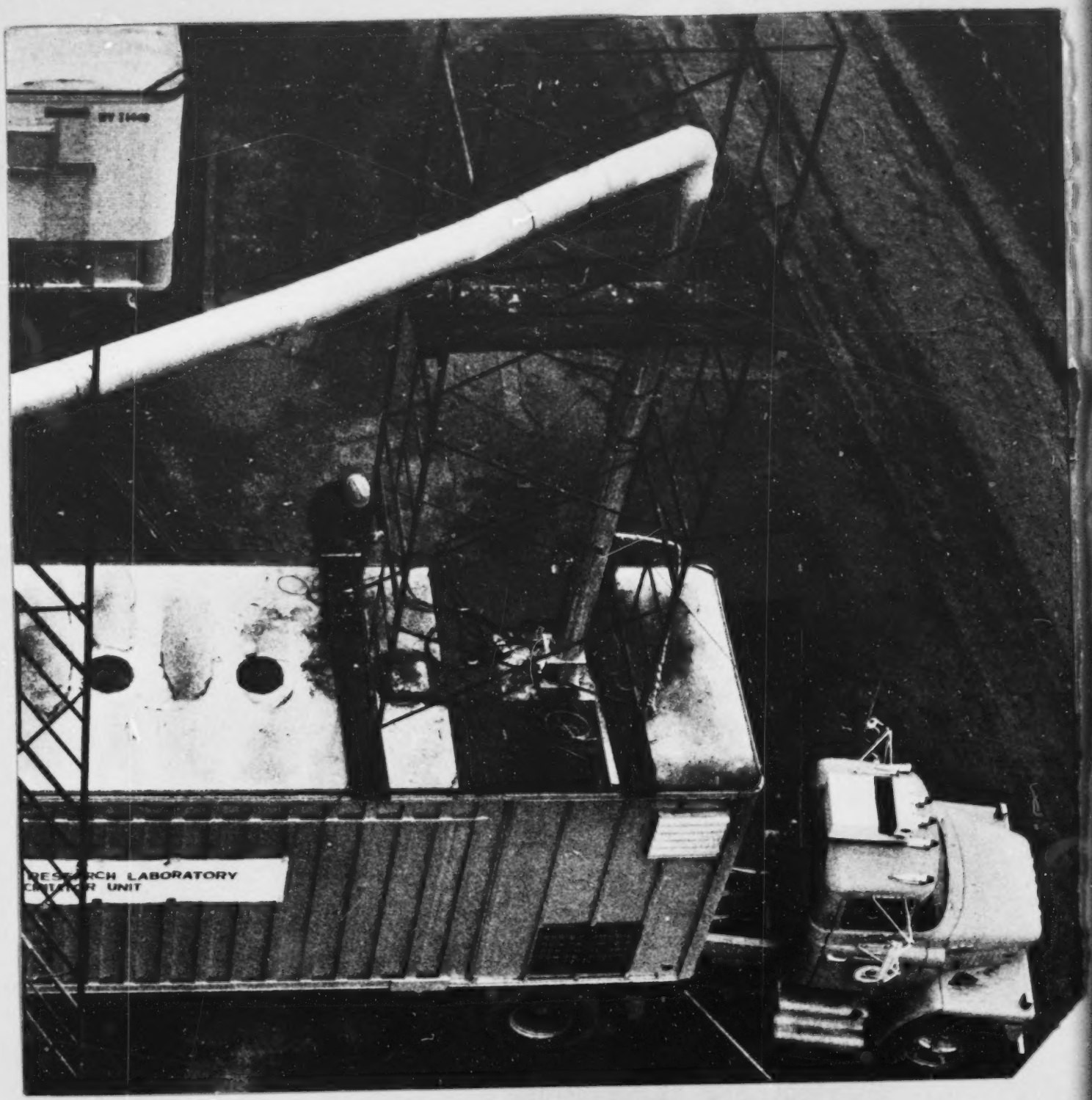
RESEARCH LABORATORY

Finding Better Ways To Control Particulates

This year, industries and utilities in the United States will spend close to a billion dollars on devices to control particulates.

Unfortunately, millions of dollars of this money will be spent to improve control devices that have already been installed. If more information was available about how particulate collectors operate on specific process equipment, a good deal of this money could be saved. But site-specific information on full-scale particulate control devices is hard to obtain.

Because particles can behave unpredictably, a control device that works fine at one plant may be only marginally efficient at another. Even where the processes are similar, differences in temperature, pressure, or the chemistry of fuels can drastically alter collector efficiency. Because of the lack of site-specific information, many utilities and industries invest in larger, more expensive particulate control devices than they need. Or — even worse — in an inadequate system that can't bring the plant into compliance with regulatory standards.

To help solve this problem, the Environmental Protection Agency has developed three mobile particulate collection vans.

Each van houses a pilot-scale version of a conventional control device — fabric filter (baghouse), wet scrubber, or electrostatic precipitator (ESP). The vans are based at EPA's Industrial Environmental Research Laboratory in Research Triangle Park, North Carolina. From there, they travel to factories and power plants all over the country to collect performance data.

This data helps both industry and EPA. It gives industry facts and figures on how to buy and install more efficient, cost-effective particulate control equipment. And it gives equipment manufacturers and EPA information on how to design better particulate control devices for the future — for conventional as well as alternate fuels and processes.

Many utilities and industries have hosted the mobile vans since the program was begun in 1973. In doing so, they have contributed to research that will give America the energy it needs, without polluting our environment.

In the following pages, you'll find a complete explanation of what's involved in hosting a mobile particulate control van at your plant — including specifications for installation and operation of the equipment.

If you're interested in taking part in the program — or if you'd simply like more information — please contact:

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Particulate Technology Branch
Mobile Collectors
Industrial Environmental
Research Laboratory
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North Carolina 27711
(919) 541-2925

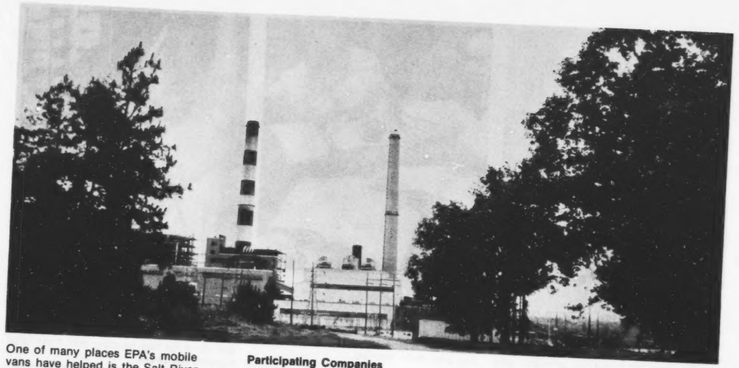
The Mobile Vans

Since 1973, EPA's mobile vans have tested the performance of particulate control devices at a wide variety of sites, from a 2400-megawatt generating station in Page, Arizona to a pulp mill in Plymouth, North Carolina. The operating crews are experienced in all phases of particulate sampling. Both the sampling methods and hardware they use are constantly updated to maintain state-of-the-art operation.

From the stack breeching to the trailer outlet duct, each van is a self-contained unit with closely controlled operating parameters. Because many of the factors that affect collector performance and particulate measurement are under control, test conditions can be varied. And they can be reproduced until meaningful results are obtained.

The mobile particulate vans are a good example of how both government and industry can benefit from a cooperative program. Plant managers can use the information generated at an on-site test to save money on initial installation or retrofitting of existing equipment. And data we have on how today's particulate control devices work under different conditions will help in the development of improved control equipment for the years ahead.

In addition, through EPA publications, the information the vans collect is made available to a wide audience in government and industry.



One of many places EPA's mobile vans have helped is the Salt River Project. Since 1977, EPA and the Salt River Project have cooperated to find ways of improving the efficiency of electrostatic precipitators on coal-fired plants. In 1978, the mobile ESP came to the company's Navajo generating station, and the crew spent the summer conducting an extensive test program to find the most effective control equipment and procedures. The Salt River Project will use the data collected to help design more effective control devices. And the test results will be helpful to other utilities using hot-side ESP's to control particulate emissions from low-sulfur coals.

Participating Companies
Weyerhauser Corporation
Pennsylvania Power and Light
City of St. Louis
Union Electric
Hallman Foundry
Maryland Department of
General Services
Montana Power Company
Basin Electric Power Cooperative
Salt River Project
Michigan State University
Monongahela Power Company
Southwestern Public Service Company

The Mobile Van Test Program

Pre-Survey
The first step in a test program is the pre-survey. Here, you'll sit down with EPA representatives to discuss the program from beginning to end. Together, you'll work out the arrangements for the installation and operation of the mobile vans. During this meeting, EPA will brief your plant personnel about the crew's experience, and let everyone know in advance what assistance will be required from the plant. By the end of the pre-survey, everyone involved in the test program will have a clear idea of exactly what to expect.

Test Plan
After the pre-survey, EPA will draw up a detailed plan for each stage of the test program and submit it to you for approval. A typical program lasts between one and three months.

Installation
Insulated stainless steel ducting is used to connect the mobile particulate control devices to the process flow. Your plant personnel normally specify the route for this ducting and associated support hardware.

Because the best place for an access port is sometimes 150 feet up in the air, a crane and rigging crew may need to be hired from a local contractor. This contractor also usually fabricates the duct supports.

The process end of the duct is connected to a probe inserted into the gas stream. EPA supplies the probe. Cutting an access port and securing the probe is generally handled by your plant personnel, so that it can be scheduled during a shutdown. The installation requires some welding.

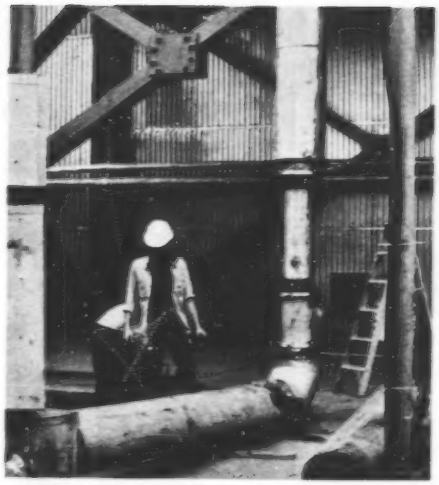
Operation

Once a mobile van is up and running, very little effort is required on the part of your plant personnel. Almost all work is done by the EPA crew in the immediate area of the van, without interfering with your operation.

During testing, the engineer in charge of the mobile van usually requests information about various process parameters. This data is important in evaluating control device performance.

Inlet and outlet grain loadings and particle size distributions are usually available within 48 hours after a sample is taken. This means the EPA crew can fine-tune the test program while it's in progress.

Since data collected by the different mobile vans are directly comparable, it may be advantageous to test the same process with two vans at the same time. This can be done with very little additional hardware or installation time.



Post-Test Procedures

The ash or sludge from the mobile control devices is dumped in 55-gallon drums. These drums are handled with a forklift, usually provided by your plant. Since full drums are moved only a few times during most programs, this does not require much time or effort.

When testing has been completed, a contractor is usually called in again to remove ducting. The slipstream port is capped and the duct is loaded into the vans. Then the crew heads home, for maintenance, or directly on to the next test site.

Test Results

The data collected during a test program are sent to EPA's Industrial Environmental Research Laboratory (IERL) in Research Triangle Park, North Carolina. There, the data are evaluated and become part of the statistical base for IERL's particulate control device analyses. Test results are also incorporated into other EPA particulate control programs.

A summary of the test data is also sent to your plant, where it should be valuable in improving the efficiency of existing particulate control equipment or in deciding what new devices best fit your process.

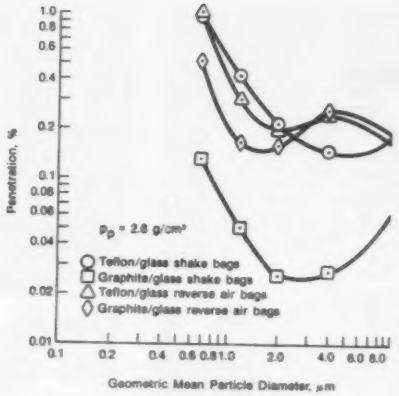
Mobile Baghouse

EPA's mobile baghouse is equipped to investigate all major factors that affect the collection performance of a fabric filter device.

The mobile baghouse can be adapted to bag cleaning in three different modes: shaking, pulse jet, or low-pressure reverse flow. Cleaning parameters like duration, pressure, and frequency can be varied over a broad range. To better simulate realistic conditions, the baghouse can be run 24 hours a day during a test program.

During May, June, and July of 1977, the mobile baghouse tested at the Southwestern Public Service Company power plant in Amarillo, Texas. The objective of this program was to characterize baghouse operation and particle collection capabilities on a utility boiler burning pulverized Western coal. A companion study was conducted during the winter of 1977-78 at the Michigan State University power plant in East Lansing, Michigan. These two studies have provided data for a comparison of baghouse performance on boilers firing Eastern and Western coal.

The baghouse has also tested on effluents from a brass and bronze factory, a hot-mix asphalt plant, a utility boiler burning anthracite coal, a pulp mill lime recovery boiler, and the St. Louis refuse processing plant.



Mobile Baghouse Test
Amarillo, Texas

Mobile Baghouse Specifications

General	
Equipment Size	40 ft x 8 ft trailer
Flow Capacity	50-150 acfm
Power Requirements	240 V, 150 amp 3 phase or 480 V, 75 amp 3 phase
Operating Temperature	Ambient to 550°F
Pressure Drop	0-20 in. of water
Bag Face Velocity	0-20 fpm
Number of Bags	1-7
Bag Length	4-10 ft
Bag Diameter	4-12 in.
Bag Cleaning	Shake, reverse flow, pulse jet
Ducting	
Pipe	2.5 in. O.D., Schedule 5
Pipe and Flange Material	Type 316 stainless steel
Weight	2 lbs/ft
Section Lengths	8, 10, 20 ft
90° Elbow Radius	5 in.
Insulation	1 in. fiberglass

Designed by:
GCA Corporation

Built by:
GCA Corporation and
Monsanto Research Corporation

Mobile Wet Scrubber

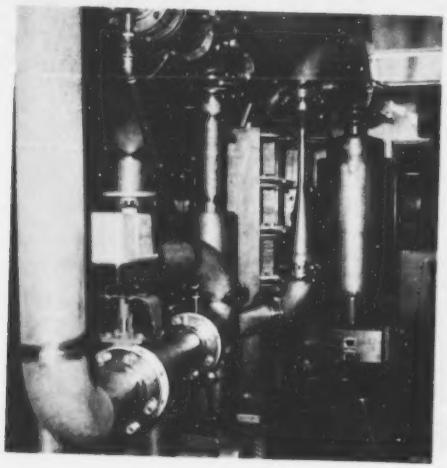
The mobile wet scrubber is equipped with a pilot-scale venturi and a pilot-scale sieve tray scrubber. Both types are built into the van so that side-by-side comparisons can be made of their collection efficiency for many different processes.

Other flexible parameters in the design of the van make it possible to evaluate the effects of liquid-to-gas (L/G) ratios, pressure drop, venturi throat velocity, and sieve tray hole sizes on particle collection efficiency.

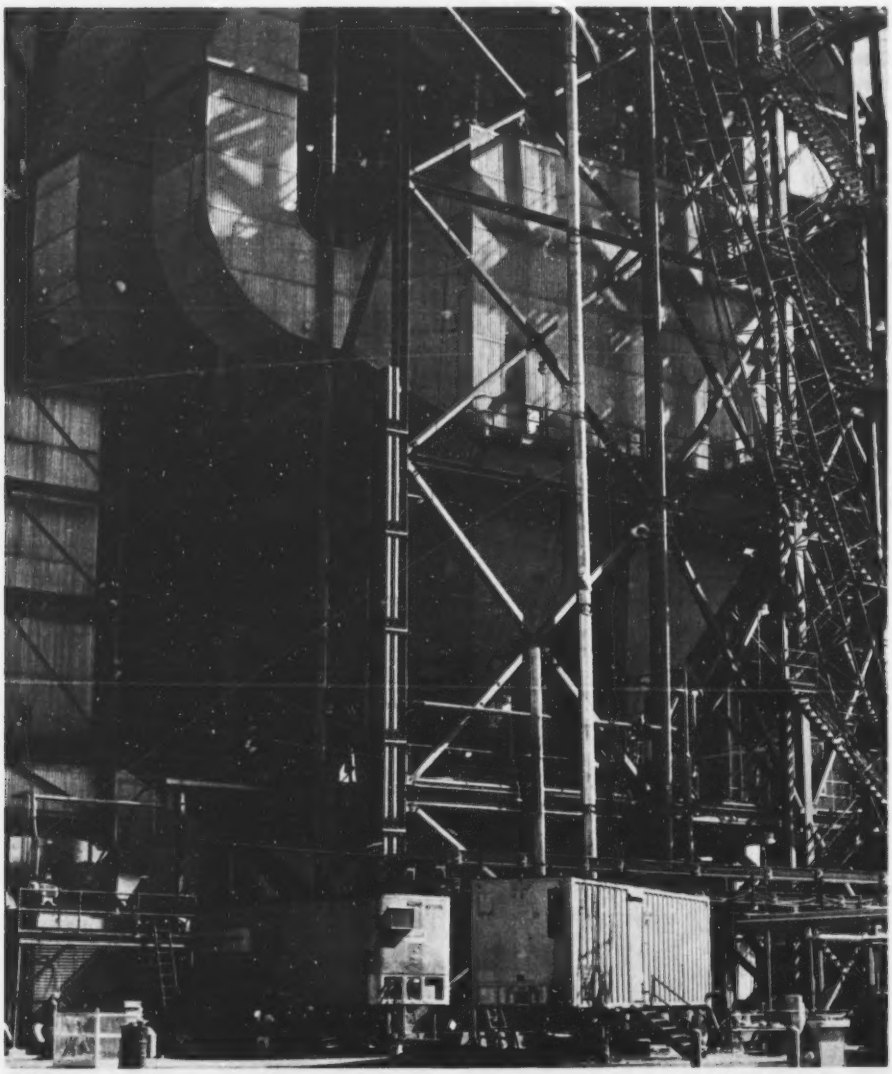
Since its delivery in December 1975, the mobile scrubber has participated in testing programs at Pennsylvania Power and Light Company's Sunbury generating station, at a pulp mill lime recovery boiler, an iron foundry cupola furnace, and a small utility boiler.

Mobile Scrubber Specifications

General	
Equipment Size	40 ft x 8 ft trailer
Flow Capacity	200-600 acfm
Power Requirements	240 V, 200 amp 3 phase or 480 V, 100 amp 3 phase
Operating Temperature	Ambient to 900°F
Pressure Drop	0-100 in. of water
Liquid-to-Gas (L/G) Ratio	5-50 gpm/10^3 acfm
Venturi Throat Size	1.38, 2.36, 3.34 in.
Venturi Throat Velocity	100-400 fps
Number of Sieve Trays	4
Sieve Tray Perforation Size	0.125, 0.188, 0.250 in.
Ducting	
Pipe	6 in. O.D., Schedule 5
Flanges	6 in. 150 #
Pipe and Flange Material	Type 316 stainless steel
Weight	3 lbs/ft
90° Elbow Radius	10 in.
Insulation	1 in. fiberglass
Designed by:	
Air Pollution Technology, Inc.	
Built by:	
Naval Surface Weapons Center	



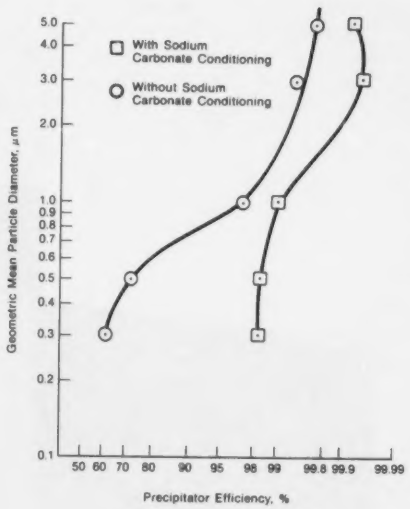
Mobile Electrostatic Precipitator



The mobile electrostatic precipitator (ESP) and control and laboratory facilities occupy two 40-foot trailers. Five precipitator sections, or cells, are located in the process van, along with a 3000 acfm industrial blower and a dust conveyance system. All process controls, monitors, recorders, and the power distribution center are in the laboratory trailer.

Flexible operating parameters for the ESP include gas velocity, collector plate area, current density, periodicity and intensity of plate and corona frame rapping, and corona wire diameter and spacing.

At test programs in Montana, North Dakota, and Arizona, the mobile ESP has been used to investigate the effect of flyash conditioning agents on ESP performance. In these programs, precipitator parameters were held constant while conditioning agents were varied in type and amount. Tests at Colstrip, Montana showed that the injection of sodium carbonate into the slipstream produced a 12½ percent improvement in collection efficiency for particles smaller than half a micron and reduced particulate emission levels from 0.12 down to 0.036 lbs/MBtu.



Results from Mobile ESP
Colstrip, Montana

Mobile ESP Specifications

General	
Equipment Size	Two 40 ft x 8 ft trailers
Flow Capacity	1000-3000 acfm
Power Requirements	• 240 V, 175 amp 3 phase or 480 V, 90 amp 3 phase • 240 V, 100 amp single phase with neutral wire for 120 V service
Operating Temperature	Ambient to 900°F
Operating Voltage	20 to 50 kV
Collection Plate Area	480 ft²
Number of Fields in Series	2-5
Ducting	
Pipe	10.5 in. O.D., Schedule 5
Flanges	10.5 in., 150 #
Pipe and Flange Material	Type 316 stainless steel
Weight	35 lb/ft (fabricated)
Section Lengths	20, 8 ft
90° Elbow Radius	15 in.
Electric Heat Load	150 watts/ft
Insulation	3 in. mineral fiber mat ½ in. glass fiber mat ⅛ in. aluminum sheathing

Designed by:
Southern Research Institute

Built by:
Naval Surface Weapons Center

Your Support Counts

That's the mobile van story to date. Expert engineers and technicians, accurate measurements, unique pilot-scale equipment. Easy installation and removal. The test planning and data evaluation resources of the Industrial Environmental Research Laboratory.

What makes it all work are companies who are interested in the kinds of questions the vans are designed to answer. With the support of utilities and industry, the EPA mobile particulate control program has succeeded in providing valuable data. We hope your company has a place in continuing that success.

Prepared by Acurex Corporation under EPA contract. Photos courtesy of Acurex Corporation, Envirotech Corporation, Monsanto Research Corporation, U.S. Environmental Protection Agency, and the U.S. Navy.

This report has been reviewed by the U.S. Environmental Protection Agency and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.